

CLAIMS

What is claimed is:

1. A response device compatible with a magnetic resonance imaging (MRI) apparatus and similar medical techniques associated with strong magnetic environments, the device comprising:
 - a keypad connected with a fiber optic cable to an electronic unit that includes photoelectric means for illuminating optical fibers in said fiber optic cable, photodetecting means for detecting the light coming from said keypad through said fiber optic cable, and signal processing means for processing signals from said photodetecting means, and communication with external devices;
 - fiber optic push button switches that are located in said keypad to be pressed by a patient who is undergoing a response test, each said fiber optic switch comprising:
 - a base and an actuator that can move in said base while being pushed at the depressing end;
 - a spring that keeps said actuator in a fixed position in said base when said actuator is not depressed;
 - an illuminating fiber that provides light to a shutter that is attached to another end of said actuator ;
 - a receiving fiber that is located in said base coaxially with said illuminating fiber, said receiving and illuminating fibers providing a gap for sliding said shutter in it when said shutter moves in said base;
 - a body of said keypad represents a box with a plurality of holes in the front, left, and right sides for mounting of said fiber optic push button switches in different locations on the keypad.
2. The response device of claim 1 wherein each said fiber optic push button switch comprises:
 - a base and an actuator that can move in said base while being pushed at the depressing end;

- a spring that keeps said actuator in a fixed position in said base when said actuator is not depressed;
- an optical fiber that provides light to a reflective surface at another end of said actuator and collects light that is reflected from said reflective surface.

3. The response device of claim 1 wherein:

- said base of said fiber optic push button switch has a snapping means on its top surface;
- an internal surface of said box has a snapping means that mates with said snapping means of said base;
- said fiber optic push button switch is mounted inside of said box by mating said snapping means on said base and said internal surface;
- said depressing end of said actuator is facing out from an external surface of said box at a distance from 2 to 20 mm;
- said depressing end of said actuator is inserted in one of said openings in said box;
- said depressing end of said actuator can slide in an opening where it is inserted.

4. The response device of claim 1 wherein:

- said base of said fiber optic push button switch has a snapping means on its bottom surface;
- an internal surface of said box has a snapping means that mates with said snapping means of said base;
- said fiber optic push button switch is mounted inside of said box by mating said snapping means on said base and said internal surface;
- said depressing end of said actuator is facing out from an external surface of said box at a distance from 2 to 20 mm;
- said depressing end of said actuator is inserted in one of said openings in said box;
- said depressing end of said actuator can slide in an opening where it is inserted.

5. The response device of claim 1 wherein said fiber optic push button switches are located on said box in positions that provide ergonomic depressing of said switches with fingers.

6. The response device of claim 1 wherein two keypads are connected to said electronic unit, one keypad to be activated with the left hand and another keypad to be activated with the right hand.

7. The response device of claim 1 wherein said fiber optic push button switches are located on said box in positions that are equidistant from a central opening on a front side of said box.

8. The response device of claim 7 wherein said four fiber optic push button switches are located on said front side in a square arrangement.

9. The response device of claim 7 wherein said eight fiber optic push button switches are located on said front side in a circular arrangement.

10. The response device of claim 7 further comprising:

- a knob that is inserted into said central opening;
- said knob has a flange that can touch all said depressing ends of said fiber optic push button switches;
- said knob can be tilted and rotated inside said central opening and said flange can press said depressing ends of said fiber optic push button.

11. The response device of claim 10 further comprising:

- a handle with a start button on it;
- said start button is connected to a movable fiber optic switch that is inside of said box and is attached to the end of said handle that is inserted into said central opening.

12. The response device of claim 10 further comprising:

- an elastic ring that is located under said flange;
- said ring holds said knob perpendicular to front side of said box if said knob is not tilted;
- an insertion part of said knob has a fixing means that prevents said knob from being removed from said box when said knob is tilted and rotated.

13. The response device of claim 6 wherein:

- said keypads are connected with peripheral fiber optic cables to a Y-box ;
- said Y-box is connected to said electronic unit with a main fiber optic cable.

14. The response device of claim 13 further comprising:

- a third keypad with said knob in it;
- said third keypad is connected with said peripheral fiber optic cable to said Y-box.

15. The response device of claim 14 wherein:

- said main fiber optic cable has a length from 10 to 30 m;
- said peripheral fiber optic cable has a length from 0.5 to 2.5 m.

16. The response device of claim 1 wherein:

- said electronic unit has a plurality of light sources coupled to illuminating optical fibers of said main fiber optic cable;
- said electronic unit has a plurality of photodetectors coupled to receiving optical fibers of said main fiber optic cable;
- said light sources and photodetectors are controlled by a microcontroller;
- said microcontroller provides output signals that correspond to pressing events of said fiber optic push button switches.

17. The response device of claim 16 wherein said microcontroller provides output signals that are synchronized with external sound or visual stimuli that are provided to said patient.

18. The response device of claim 16 wherein said microcontroller provides output signals that are synchronized with signals from the MRI scanner.
19. The response device of claim 1 wherein said microcontroller provides an indication on a screen located on said electronic unit about which said fiber optic push button switches is depressed in each moment.
20. The response device of claim 1 wherein all parts, except said electronic unit, are made of non-ferrous materials.

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